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ABSTRACT

Research is showing that the incidence of minor physical abnormalities correlates with learning and behavioral problems in children. J. Rappoport and associates at Georgetown University have developed a scale to count such physical abnormalitites as the epicanthus fold, placement of ears, curve of little finger, length of toes, or lack of earlobes. The number of such abnormalities, not the kind, correlates positively with such behavioral disturbances as aggression, impulsivity, inhibition, and anxiety. The use of the scale can identify infants at risk for later learning and behavioral problems leading to an appropriate preventive program. (DB)

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The Tie Between Physical and Behavioral Irregularities of Children

by Herbert Yahraes

When Tom was 3½ years old, the family doctor referred him to a clinic at Georgetown University, Washington, D.C., to learn if anything could be done to curb his aggressive and overactive behavior. He was driving his parents beyond the limits of their patience with his excessive demands for attention, and he was frightening them by biting his arms whenever angered, which was often.

The clinic personnel found him extremely distractible but could detect nothing wrong neurologically; his IQ, at 126, was well above normal. Clearly, Tom was one of the many hundreds of thousands of children who have been labeled "hyperactive" and who, unless successfully treated, sadden and madden families and disrupt classrooms. Conduct problems—though rarely delinquency—often go hand in hand with hyperactivity. The cause is yet unknown, though some authorities term it "minimal brain dysfunction," which simply means that a little something somewhere in the brain is not operating exactly as it should.

But Tom had something else, something that two of the clinic personnel, child psychiatrist Judith L. Rapoport and pediatrician Patricia O. Quinn, were particularly looking for. He had an unusually high score, 9, for minor physical anomalies—meaning slight deviations or irregularities. These are sometimes called "stigmata."

For example, his head circumference was a little greater than normal (had it been less than normal, that, too, would have been counted an anomaly); his hair was so fine that it wouldn't stay combed; the point where the upper and lower eyelids join at the nose was partly covered by the so-called "epicanthus fold," giving the boy a very slight Oriental look; his ears were set a little lower than normal; the roof of his mouth was a little too high; his little fingers curved slightly inward toward the other fingers; and his third toe was longer than his second toe.

Hundreds of such minor physical abnormalities—which are so slight that they are not noticed even by physicians unless a special search is made—have been found in children. Some investigators, however, have used a list of from 16 to 18 of them in their research. Among those on the list, in addition to the ones named above, are items such

as: more than one hair whorl; unusually wide-set eyes; malformed or asymmetrical ears, or no earlobes; a furrowed tongue; one unbroken crease or line running across the palm of the hand; the partial webbing of two toes; a slightly greater than normal gap between the first and second toe.

The majority of children are born with two or three such anomalies, but it has been known for a long time that Mongoloid children (properly called "children with Down's Syndrome") tend to have an unusual number of them. Psychiatrist William Goldfarb has found an unusual number of anomalies to be associated also with childhood schizophrenia. And links have been found, too, with severe learning disability, delay in speech, autism, and borderline psychosis.

Investigators, studying fetuses aborted at different stages, have learned that the anomalies develop during the first 3 months of pregnancy. Some of the anomalies are associated with drugs taken in unsuccessful attempts to induce abortion. Also, some studies show that children with high anomaly scores often have fathers with a history of hyperactive behavior or mothers with a history of prenatal problems. A recent finding, discussed later, points to another possible factor—a slight biochemical abnormality present at birth.

Much of the most recent research in this field has been done by Rapoport and her associates at Georgetown University. They are building upon the pioneering work begun in the 1960s by developmental psychologist Mary F. Waldrop and her fellow workers at the National Institute of Mental Health. The Waldrop investigations are continuing. Such research appears unusually important because it offers the hope that the early detection of minor anomalies—the investigators find that they can be detected even at birth—can lead toward early identification of some children who are at risk for developing problem behaviors and perhaps toward preventive measures.

The problem is complicated, however, because some children with higher-than-average anomaly scores—in Rapoport's work, as high as 10—seem perfectly normal; these so-called false positives have not been found to the same extent by Waldrop, possibly because her samples were younger and did not come from clinical populations. Rapoport has also found that children who become hyperactive only when they have reached school age are unlikely to have more than the usual number of slight physical imperfections. So in hyperactivity, which is one of the most widespread of behavior problems, more than one process may be at work.

Number Important: Not the Kind

Waldrop's research on minor anomalies began more than 12 years ago. Using the findings of Goldfarb and pediatrician Anne Botstein about the relationship between anomalies and childhood schizophrenia, Waldrop developed a now widely used scoring system under which a given anomaly is rated either 1 or 2, depending upon its severity. She also developed an illustrated manual for assessing the anomalies.

In her first study, Waldrop and her associates, Frank A. Pedersen and Richard Q. Bell, observed and examined a number of presumably

normal children, 2½ years old, who were attending a nursery school in the early 1960s. The research team found a relationship between the *number* (not the *type*) of anomalies and the presence of certain behavior difficulties. The more physical anomalies the children had, the more likely that these toddlers were hyperactive, aggressive, and difficult to manage.

As an example of typical behavior by a high-anomaly child, here is a description written by Waldrop from daily notes made by a nursery school teacher who had no information about the anomaly scores of the children in her group. The boy's name is a pseudonym.

> Our first glimpse of Norman gave a strong impression of the type of child we were about to meet. His mother had a firm grip on his wrist and Norman was straining to get away from her.
>
> During nursery school it seemed as if he was trying to be at all parts of the playroom at once. He did not sustain an activity for more than a few minutes, nor become involved in his play. Norman liked moving at full speed and seemed to enjoy the bumps and falls which followed his reckless pace (riding a bicycle backward down the hill, swinging on his stomach in a swing, then dive bombing—falling head first—onto the ground). Norman was extremely impatient, wanting to be first and to have the most, then not playing with what he did get; for example, he would "fight" to get all the bells, then not ring them. During a series of psychological tests, he did not want to do the task that was presented but was eager to see what the next one would be. His IQ was above average.
>
> He was frequently in conflict with peers, usually caused by his going around the playroom, intruding himself in a child's play activity, briefly mimicking what he or she was doing, then going on to another locale. If any child tried to shove him out of the way he would start fighting. He displayed aggression toward peers by pouring water on a child's head, putting paint on a child, spitting at them, yelling at them, hitting them, snatching and breaking their cookies, walking across their stomachs when they were lying down. Once when a child was playing with some wooden rings he grabbed them and threw them across the floor; another time he took away a child's jewelry and threw the pieces over the fence.
>
> His impulsiveness was shown by his pouring salt on the floor, putting his finger over the end of a faucet so that it would make a shower, and throwing pegs, puzzle pieces, and records on the floor.

Five years later, Waldrop and another associate, Charles F. Halverson, Jr., took a look at the same children. They found that those who had been hyperactive at 2½ years tended also to be hyperactive at 7½ years. The anomaly scores were stable across the two ages.

In a 1977 report, a team headed by Waldrop made an even more significant announcement. Boys had been examined for minor physical anomalies soon after birth and then, again, 3 years later. The number of these anomalies at birth was found to be significantly related to short attention span, impulsivity, and aggression toward other children—all factors that are included in the term "hyperactivity." And the anomaly score at 3 years of age was usually the same as it had been at birth. In other words, minor physical anomalies at birth can predict certain behaviors in later years, though not in every case. As the investigators put it: ". . . it was not unusual for boys who were seen as hyper-

active to have had low newborn anomaly scores, but it was very unusual for boys with high newborn anomaly scores *not* to be seen as hyperactive at age 3." In other words, there were very few false positives.

With her fellow workers, Waldrop has examined many groups—nursery school children, newborns, 3-month-olds, samples of girls, and a sample of children with speech or hearing difficulties. All but one of her samples came from the general population. The higher the anomaly scores, the research has continued to show, the more likely that the child has short attention spans and is impulsive, excessively active, and aggressive toward his peers. The scores have ranged from 0 to 11 for boys, 0 to 8 for girls. Both the teachers and the investigators describe the behaviors in the same way.

Waldrop and Halverson have also found that a sample of children with somewhat severe congenital problems of speech or hearing, or both, had significantly more physical anomalies than did children from the general population.

A replication of the original nursery school study yielded interestingly different results. The boys with the higher-than-average anomaly scores were similar to the boys in the first study—impulsive and difficult to control. But the girls tended to be withdrawn, stubborn, fearful, and socially ill at ease. This finding for girls held up in an elementary school study and in a study relating anomalies in newborns to the behavior of these children in nursery school. Elementary school girls rated by their teachers as fearful and inhibited were discovered to have statistically significant higher anomaly scores than the girls rated as socially at ease and outgoing.

Why the difference? Of the two main types of behavior disorders, the research team pointed out, the one characterized by aggression, rebellion, and acting out (that is, expressing emotional conflicts in antisocial acts rather than in words) tends to be associated with boys. But the group of disorders characterized by inhibition and anxiety tends to be associated with girls. Since the minor physical anomalies in boys were associated with a problem characteristic of boys, Waldrop reasoned that the same aberrations in girls should be associated "with the most salient problem of girls—that is, with inhibition."

At the root of the difference may be simply the age-old difference (found in many families even today, long after the start of the women's liberation movement) in the behaviors expected of the sexes. As Waldrop notes, boys have been expected to be assertive; girls have not been. As for the high-anomaly girls in her first study, who were hyperactive, maybe they had not quite reached the age of learning to overcompensate for their hyperactive urges.

Body Chemical May Be Implicated

Rapoport and her fellow scientists recently have turned up evidence that a biochemical factor may be somehow related to minor anomaly scores. The factor is an enzyme, dopamine-beta-hydroxylase (DBH), responsible for the final step in the production of norepinephrine. This latter biochemical is one of the major compounds having a vital role in the transmission of messages from nerve cell to nerve cell. Changes in

DBH activity can be measured by the amount of the enzyme in the blood plasma at various times; they may indicate changes in the activity of the nervous system.

Among boys attending Georgetown University's hyperactivity clinic, the investigators turned up one old finding and one new finding. They learned, as before, that the higher the score for minor anomalies, the greater the probability that a boy's record for hyperactivity and other problem behavior would also be high. The new finding was this: High anomaly scores were significantly related, for the group as a whole, to high amounts of DBH in the blood plasma.

The Rapoport team then began looking for a possible connection between the amount of DBH in the plasma of newborn infants—an amount which is genetically determined—and the same babies' behavior 5 months and 1 year later. The sample included approximately 60 infants each in three categories—those with high anomaly scores, those with low, and those with medium.

When the babies were 5 months old, the mothers filled out the Carey Infant Temperament Scale, a questionnaire that helps to categorize a baby's temperament. No statistically significant relationship showed up between the anomaly score and any item on the temperament measure.

However, low but significant relations did appear between 10 of the items and the amount of DBH. For example, 5-month-old babies whose level of DBH at birth had been higher than average tended to keep fussing until given a desired food; to fuss persistently when a diaper was soiled; to cry persistently when getting a "shot"; to react negatively to sounds, lights, and strangers; and to make glum and unfriendly responses even to familiar persons. The babies with the high DBH levels, in other words, were more likely than the others to respond negatively in a number of situations.

When the babies were 1 year old, those with the highest DBH levels at birth "tended to have an intense, dramatic dislike of new foods" and were again rated on the items as fussier about soiled diapers, "shots," and responses to familiar persons. There was a suggestion that, more often than the laws of chance would predict, their temperaments would fall into the type that has been characterized by other investigators as "difficult." And a temperamentally difficult child, it has been shown, is more likely than other children to develop behavior problems at home and in school.

Moreover, the Rapoport team found a significant relation between the DBH level at birth and the anomaly score at 1 year. Possibly, whatever happens early in fetal development to produce the anomalies may also permanently influence the biochemical operations involving DBH —and, for all anyone yet knows, other compounds as well.

Some other findings by the Rapoport group:

- The anomaly scores at birth were much the same a year later.
- On tests of mental and motor abilities when the children were 1 year old, no significant differences appeared between those with high anomaly scores (5 or more) and those with low (2 or less).

- A significant relationship appeared between irritability at 1 year and both the newborn and 1-year anomaly scores. The chance that the relationship was fortuitous was 1 in 100.
- In the children with high anomaly scores, there was also a significant relationship between irritability and a family history of disorders of learning or behavior, or of both. Also, there was a strong relationship between overactivity at 1 year and such a family history.
- Overactivity at 1 year was associated, too, with complications of pregnancy.

The findings suggest that children "with *both* a high anomaly score and either a familial history of hyperactivity or a maternal history of pregnancy and obstetrical complications may be identified early in life as being at risk for the development of irritability and/or hyperactivity at 1 year and possibly problem behaviors in later childhood." The investigators also think that the findings reveal something about the possible cause of high anomaly scores: a congenital element that may be either genetic in nature or a toxic factor operating during pregnancy.

In another study, child psychiatrist John P. Steg and Rapoport examined 108 boys from four different clinical populations—general pediatric ward patients, psychoneurotic outpatients at a child guidance clinic, children with learning disabilities, and disturbed children from two residential treatment centers.

Both the children in the residential treatment centers and the children with learning disabilities were found to have higher average anomaly scores than the other children. The average of the scores in the two high-rating groups did not differ significantly from each other. Boys with many anomalies were more likely than the others to have fathers with a history of psychopathology or mothers with a history of pregnancy problems.

The results indicate that the development of the anomalies "may parallel early developmental deviation of the central nervous system."

What does it all add up to? There is some rather strong evidence that certain minor physical imperfections with which a child is born are somehow linked—if more numerous or severe than on the average—to troublesome behavior later on, particularly hyperactivity. Thus the minor anomaly score may serve to alert parents and physicians to the possible need for early treatment and the establishment of guidelines and boundaries to help a child contain a tendency to be too active and too easily distracted.

Prevention and Treatment

Prevention is preferable to treatment. Unfortunately most hyperactive children are brought to physicians expert in their care—usually pediatricians and child psychiatrists—too late for much to be done in the way of prevention.

Many hyperactive children like Tom, mentioned at the beginning of this report (*too* many, in the view of a number of authorities), are given one of the stimulant drugs, which in such children often have a calming

effect. Rapoport has seen children who are getting some benefit from the drugs as long as 8 years after they were first prescribed. On the other hand, a followup of children who had been placed on the drugs 2 years earlier was disappointing: Those who had continued to take them seemed to be having as much trouble socially and academically as those who had discontinued them.

On the theory that hyperactivity may be a form of depression—and many hyperactive children do have symptoms of that condition—investigators have tried antidepressant drugs such as imipramine. Rapoport has found that imipramine is effective with hyperactive children for the short run only.

How do the drugs work? Stimulants are known to increase the amount of two of the major transmitters, norepinephrine and dopamine, at the synapses. These are the gaps between nerve cells that the transmitters bridge, enabling the brain's electrical message to race through the nervous system without hindrance. The antidepressant drugs are known to increase the amount of norepinephrine only. But it is not yet clear, Rapoport explains, which of these transmitter compounds, if either, is responsible for the drugs' effects.

If parents can be taught behavior modification techniques, which essentially call for immediately rewarding desired behavior and ignoring or punishing undesired behavior, such methods often can be used to curb hyperactivity. They are frequently employed by, and can be learned from, clinical psychologists working in schools, mental health centers, hospitals, and private practice. Some psychiatrists also use behavior modification.

What eventually happens to hyperactive children who have not been treated or for whom treatment has failed? An investigation headed by psychiatrist Gabrielle Weiss of McGill University found that as these children reach adolescence they express their restlessness in less disturbing ways, such as playing with pencils instead of running around the room. They are still less able than other children to concentrate on classroom tasks. Many have poor self-esteem, feelings of hopelessness, poor social adaptation. Most clearly characterizing the group under study was "chronic and severe underachievement in school despite the maintenance of normal or superior intelligence."

Sometime after high school, or perhaps even earlier, hyperactivity dies out, possibly because the nervous system has matured or has somehow overcome the original trouble. The tragedy is that even when it dies out, the affected person's earlier tortured experiences with family, peers, and teachers—springing, to be sure, from his own behavior—may have left him with a self-esteem so low that major emotional problems continue.

A large number of middle-class fathers of hyperactive children have told the Georgetown group of their many job shifts, problems with alcohol, and arrests for speeding and fighting. Some people in the field consider such behavior the young adult outcome of hyperactivity. Actually, says Rapoport, it is antisocial behavior, and there is no evidence as yet that it is related to earlier hyperactive behavior. But it *could* be

related to the emotional problems that former hyperactives may have faced, as just noted.

In any event, the physical anomalies themselves apparently persist throughout life.

Many questions about these anomalies and their relationship to emotional health remain unanswered. Both the Rapoport group's continuing study of the children whose DBH levels and anomaly scores were obtained soon after birth and Waldrop's followup of newborns may yield at least some of the answers. If so, it may be possible to do more than at present to prevent or reduce the intensity of problem behavior.

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